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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/783,265	02/19/2004	Young Nam Kim	006343.P002	7317

7590 12/20/2007

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EXAMINER	
ONEILL, KARIE AMBER	
ART UNIT	**PAPER NUMBER**
1795	

MAIL DATE	DELIVERY MODE
12/20/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/783,265	KIM, YOUNG NAM	
	Examiner	Art Unit	
	Karie O'Neill	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 October 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *8,9,12-16 and 20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-9, 12-16, 20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The Applicant's amendment filed on October 9, 2007, was received. Claim 8 was amended. Claims 1-7, 10-11, 17-19 and 21-22 have been cancelled. Therefore, Claims 8-9, 12-16 and 20 are pending in this office action.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action issued on July 24, 2007.

Claim Rejections - 35 USC § 103

3. The rejection of Claims 8-9, 12, 14-16 and 20 under 35 U.S.C. 103(a) as being unpatentable over Dasgupta et al. (US 2003/0152835 A1) in view of Gurin (US 2003/0151030 A1), are maintained.

With regard to Claim 8, Dasgupta et al. disclose a process for preparing a carbon nanotube electrode, comprising the steps of: (1) preparing an electrode material by mixing nanometer sized carbon tubes or nanofibers with spherical graphite, which contain about 1.5% to 15% carbon nanotubes, with a binder (paragraph 0023); (2) preparing a pressed electrode material by first pressing the graphite (carbon nanotube)/binder mixture into a pressed compact with copper foil on one side (paragraph 0023); and (3) subsequently heat-treating, the heat-treating temperature range being from 40°C to 140°C (paragraph 0015), the previously pressed electrode material that is placed on a current collector so that the carbon nanotubes are bonded to each other and simultaneously bonded to the current collector (paragraphs 0016 and 0023). In step 2, Dasgupta et al. do not specifically

disclose the pressed electrode material as being pressed under a pressure from 1 to 500 atm. However, it is well recognized in the art that the resulting density of the pressed powder is a function of compaction pressure, as evidenced in Figure 3 of Vu et al. (US 4,743,185) and Figure 4 of Kear et al. (US 6395214 B1). Therefore, it would have been within the skill of the ordinary artisan to fabricate the graphite/binder mixture at a pressure between 1 and 500 atm in Dasgupta et al., because Vu et al. and Kear et al. teach, respectively, the desirable green density of the mixture being achieved by modifying the applied pressure. Discovery of optimum value of result effective variable in known process is ordinarily within skill of art. See MPEP 2144.05. In step 1, Dasgupta et al. also do not disclose wherein the carbon nanotubes or nanofibers are mixed with a binder selected from a group consisting of sulfur having an average particle size of 1μm or less, or metal nanoparticles having an average particle size of 1μm or less and both of them, or by depositing a binder selected from the group consisting of sulfur having an average particle size of 1μm or less or metal nanoparticles having an average particle size of 1μm or less and both of them on the carbon nanotubes or nanofibers.

Gurin discloses carbon particles, including carbon nanotubes of both the single-walled and multi-walled type (paragraph 0056), combined with a metal coating of metal powder having an average particle size of from about 1 nanometer to 100 microns deposited on the surface of said carbon particles also having an average particle size of from about 1 nanometer to 100 microns (paragraph 0034). The metal particles are preferably selected from the group of at last one metal from Au, Ag, Pd, Pt, Cu, Ni, Fe, Co, Be, Mo, Si, Tn, Sn, Al and In (paragraph 0059). As referenced on the website

ChemicalElements.com, Indium (In) has a melting point of 156.6°C and Tin (Sn) has a melting point of 231.9°C, which falls within the heat-treating temperature range of the melting point of a binder comprising metal nanoparticles at +200°C. Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use a carbon nanotube mixed with metal nanoparticles for preparing the electrode of Dasgupta et al., because Gurin teaches the conductivity of the carbon nanotubes being enhanced with a metal nanoparticle coating, the smaller the particle size for said metal powders the better the conductivity enhancement (paragraph 0058).

With regard to Claim 9, Dasgupta et al. disclose wherein the graphite (carbon nanotube)/binder is compressed into a pressed compact with copper foil acting as a curret collector. Dasgupta et al. do not disclose that the electrode material is uniformly dispersed on the current collector and then pressed. However, it is the position of the examiner that such properties are inherent, given that both Dasgupta et al. and the instant application utilize the same materials and perform the same step of pressing. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. See MPEP 2112.

With regard to Claim 12, Gurin discloses, wherein in step (1), the mixing of the carbon nanotubes with the metal nanoparticles is performed by a method of solvent mixing (paragraphs 0127 and 0134-0136). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to solvent mix the carbon nanotubes and metal nanoparticles of Dasgupta et al., because Gurin teaches imparting metal

nanoparticles onto the surface of the carbon nanotubes to improve dispersion and reduce interfacial tension as a means to improve conductivity (paragraph 0065).

With regard to Claim 14, Dasgupta et al. disclose the process wherein the pressing in step (2) provides the electrode material in the shape of a disk or film. Dasgupta et al. call this a pressed compact (paragraph 0023).

With regard to Claim 15, Dasgupta et al. disclose the process wherein in step (3), the pressing and heating are carried out consecutively by first forming the pressed compact (paragraph 0012) and then heat treating the electrode after preparation (paragraph 0016).

With regard to Claim 16, Dasgupta et al. disclose the process wherein in step (3) the heat treatment is carried out by through thermal heating in a temperature range from 45°C to 80°C (paragraph 0016).

With regard to Claim 20, Dasgupta et al. disclose the carbon nanotube or carbon nanofiber electrode prepared for use in a lithium secondary battery (paragraph 0023).

4. The rejection of Claim 13 under 35 U.S.C. 103(a) as being unpatentable over Dasgupta et al. (US 2003/0152835 A1) and Gurin (US 2003/0152835 A1), as applied to Claims 8-9, 12, 14-16 and 20 above, and in further view of Choi et al. (US 2004/0018416 A1), are maintained. The rejection is repeated below for convenience.

Dasgupta et al. and Gurin disclose the process for preparing a carbon nanotube elelctrode in paragraph 3 above, but do not disclose wherein the method of uniformly dispersing the metal nanoparticles on the surface of the carbon nanotubes is carried out by

a method selected from the group consisting of catalytic impregnation followed by an optional oxidation or reduction, precipitation, chemical vapor deposition (CVD), electrodeposition, plasma spraying, and sputtering.

Choi et al. disclose wherein in step (1), the mixing of carbon nanotubes with metal nanoparticles is preformed by a method chosen from the group consisting of uniformly dispersing the metal nanoparticles on the surfaces of the carbon nanotubes (paragraph 0031) and wherein the method of uniformly dispersing the metal nanoparticles on the surfaces of the carbon nanotubes is carried out by a method selected from the group consisting of electrophoresis, thermal spraying, sputtering, chemical vapor deposition and any other techniques common to one of ordinary skill in the art (paragraph 0033). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to uniformly disperse the metal nanoparticles on to the carbon nanotubes of Dasgupta et al. and Gurin, because Choi et al. teach evenly distributing metal nanoparticles on to the carbon nanotubes so that they are fixed stably thereto so as not to be affected by an external force (paragraph 0029).

Response to Arguments

5. Applicant's arguments filed October 9, 2007, have been fully considered but they are not persuasive.

Applicant's principal arguments are:

(a) Dasgupta uses as a major electrode material, a spherical graphite containing about 1.5% to 15% carbon nanotubes, and as a binder, ionic conducting polymer. In

contrast, the present invention uses carbon nanotube 100% as major electrode material, and sulfur or metal nanoparticles as a binder.

(b) The electrodes prepared according to the present invention have internal resistance lower than the values of internal resistance reported previously, and this proves that the use of sulfur or metal nanoparticles as a binder is a better process for binding carbon nanotubes to each other as compared to traditional processes such as binding using organic binders or binding after surface treatments (see page 32, lines I to 6 of the present specification). Dasgupta et al. only discloses an ion-conducting polymeric binder as a binder used in manufacturing electrodes (see [0023] of Dasgupta et al.), but does not disclose or suggest the use of sulfur or metal nanoparticles as a binder and the effect of minimizing the internal resistance of the electrode by using thereof.

(c) The electrical conductivity nanocomposite described in Gurin is used for conductive inks, circuit boards, paints etc. There is no teaching in Gurin of providing the technical idea of using sulfur or metal nanoparticles as a binder in order to solve the technical problem of increasing the internal resistance of the electrodes when using organic polymers as a binder.

(d) In the present invention, pressing and/or heat treatment is for bonding between the electrode materials after mixing or deposition of sulfur or metal nanoparticles and then shaping the solid electrode materials by first pressing. Thus, as to the step (2) and (3) of the present invention, heat treatment of Dasgupta et al. and heat

treatment of the present invention are different in its purpose, temperature range and procedure.

(e) Choi et al. merely discloses metal particles as a catalyst used when generating carbon nanotubes, but does not disclose or suggest the use of metal particle as a binder for binding carbon nanotubes.

In response to Applicant's arguments, please consider the following comments:

(a) The present invention, as claimed, does not exclude using a binder comprised of materials, such as organic polymers, in conjunction with sulfur or metal nanoparticles. In Claim 8, the carbon nanotubes are not disclosed as being 100% major electrode material and the first process step of the claim is drawn to mixing carbon nanotubes with sulfur or metal nanoparticles to form an electrode material.

(b) The use of sulfur or metal nanoparticles having the effect of minimizing the internal resistance of the electrode by using thereof is not claimed in the instant application. Limitations appearing in the specification but not recited in the claim are not read into the claim. See MPEP 2106.

(c) Gurin is relied upon for teaching a method of fabrication by mixing a metalpowder and a carbon powder, both having an average particle size of rom about 1 nanometer to about 100 microns. Using sulfur or metal nanoparticles as a binder in order to solve the technical problem of increasing the internal resistance of the electrodes when using organic polymers as a binder, is not claimed in the instant application. Limitations appearing in the specification but not recited in the claim are not read into the claim. See MPEP 2106.

(d) Dasgupta et al. discloses that the heat treatment may be carried out after preparation of the mixture of carbon particles, carbon nanofibers and binder (paragraph 0016), which is what is claimed in step 3 of the instant application. Dasgupta et al. discloses that the graphite/binder mixture is compressed into a pressed compact to form the shape of an electrode (paragraph 0023).

(e) Choi et al. is relied upon to dislcose the method of uniformly dispersing the metal nanoparticles on the surfaces of the carbon nanotubes is carried out by a method selected from the group consisting of electrophoresis, thermal spraying, sputtering, chemical vapor deposition and any other techniques common to one of ordinary skill in the art (paragraph 0033). Choi et al. is not relied upon to disclose the use of metal particles as a binder for binding carbon nanotubes.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action.

In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karie O'Neill whose telephone number is (571) 272-8614. The examiner can normally be reached on Monday through Friday from 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Karie O'Neill
Examiner
Art Unit 1795

MARK RUTHKOSKY
PRIMARY EXAMINER

12-15-07

KAO